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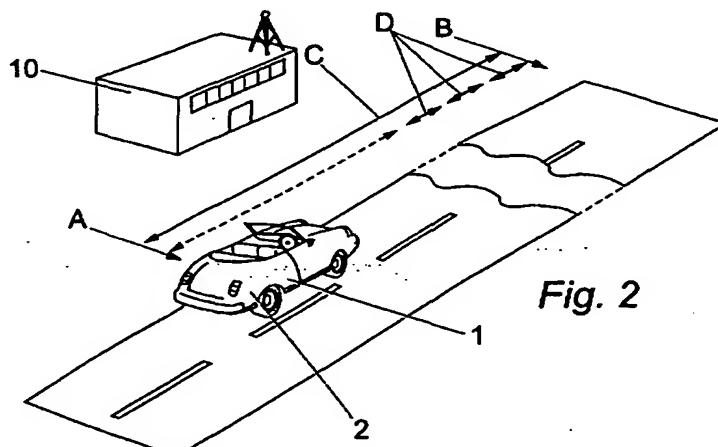
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(54) Abstract Title

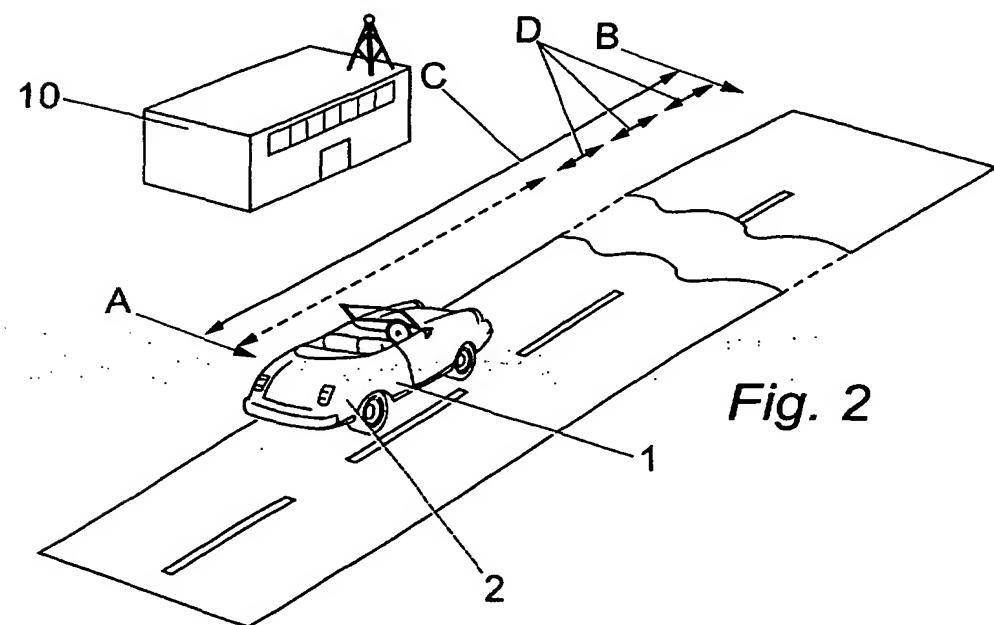
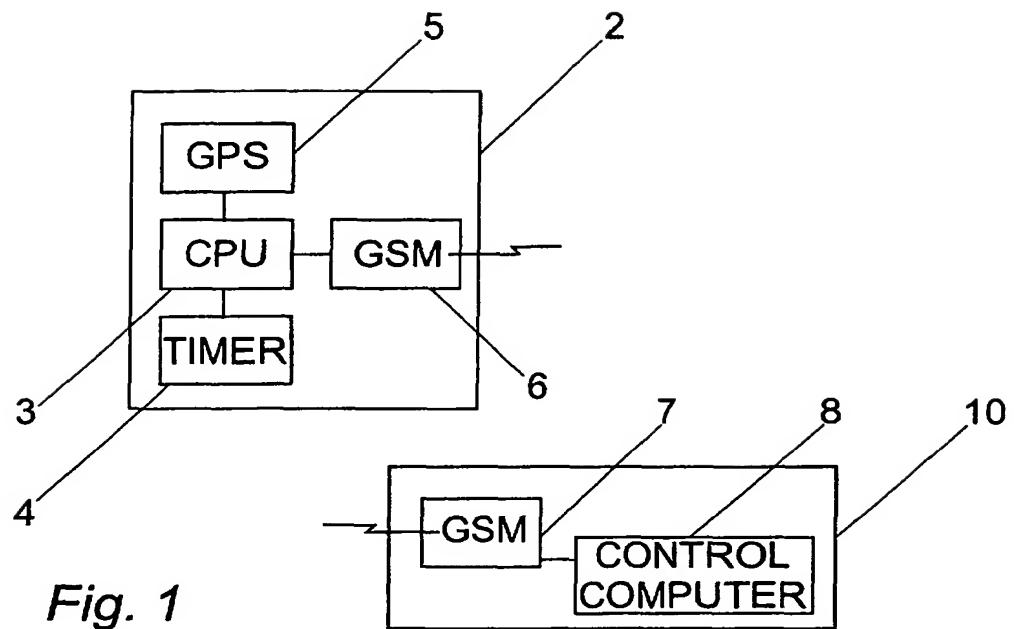
Traffic monitoring

(57) An apparatus and method for monitoring traffic comprises a plurality of vehicles (1) fitted with units (2). Each unit (2) comprises a CPU (3), a timer (4) and a GPS device (5). Whenever a vehicle (1) passes a waypoint (A) determined by the GPS device (5), the CPU (3) notes the time supplied by the timer (4). When the vehicle (1) passes the next waypoint (B) determined by the GPS device (5), the CPU (3) notes the time again. The CPU (3) subtracts the two times to derive the actual journey time for the link (C) between the two waypoints (A,B), and this is compared against a stored link-time for the link (C). If the actual journey time is greater by a preset amount than the stored link-time, then the unit (2) transmits the relevant information to a control computer (8) by way of a communication device (6). In addition to notifying the control computer (8) when the vehicle (1) has exceeded a standard time for the link (C) between the waypoints (A,B), the unit (2) can monitor the progress of the vehicle (1) along the link (C) by monitoring its progress along sublinks using a technique known as "micro-pointing".

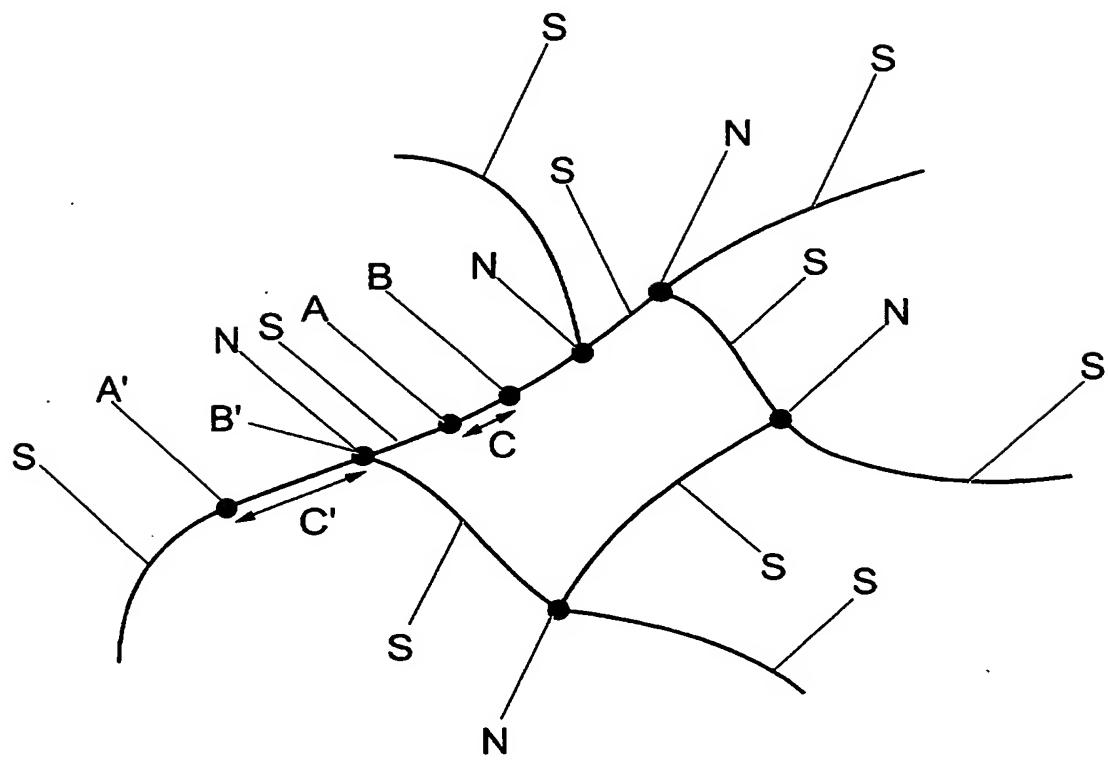


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*Fig. 3*

**APPARATUS AND METHOD FOR MONITORING TRAFFIC**

1     This invention relates to an apparatus and a method  
2     for monitoring traffic and to a method of selecting  
3     commencement and termination points for transit time  
4     measurements on a road network. In particular this  
5     invention relates to an apparatus and a method for  
6     monitoring traffic using floating car data.

7

8     The use of floating car data to monitor traffic is  
9     known. The method involves fitting a large number of  
10    vehicles with equipment which can measure the speed,  
11    position and travel direction of the vehicle and  
12    which can transmit this information to a central  
13    station. A computer at the central station then uses  
14    this received data to build a dynamic picture of the  
15    traffic on the road network in the region in which  
16    the vehicles are operating. The method requires a  
17    large number of vehicles to be fitted with the  
18    equipment and to be in motion on the road network.

1 The central computer requires a large amount of  
2 computing power, and there is a high communication  
3 cost in transmitting the floating car data from the  
4 vehicles to the central station.

5

6 EP 0 880 120 A2 (Daimler-Benz AG) describes a  
7 floating car data method in which the amount of  
8 transmitted data is reduced. In this method an  
9 automatic position detection is carried out in the  
10 sample vehicle at predetermined time intervals. The  
11 vehicle is provided with an on-board computer which  
12 stores information about the road network and the  
13 expected journey duration for sub-sections of the  
14 road network. After each position detection is  
15 carried out, the on-board computer records the sub-  
16 section travelled since the previous position  
17 detection and calculates the actual journey duration.  
18 Then, using the stored expected journey duration  
19 information, the on-board computer calculates either  
20 the expected position for the actual journey duration  
21 or the expected journey duration for the actual  
22 position, compares the expected position or journey  
23 duration with the actual position or journey  
24 duration, and transmits data relating to the traffic  
25 situation only if the difference is greater than a  
26 predetermined threshold.

27

28 WO 98/12682 (Detemobil) describes a floating car data  
29 method in which the amount of transmitted data is  
30 reduced. In this method each vehicle is provided  
31 with a decentralised unit which is able to determine

1 position and to transmit and receive data by mobile  
2 communication. A central unit at a central station  
3 is allocated to several decentralised units. Each  
4 decentralised unit contains a database of road  
5 network information which is a subset of the database  
6 of road network information contained by the central  
7 unit. The central unit activates programs stored in  
8 the decentralised unit through control signals  
9 transmitted from the central station to the vehicle.  
10 The reporting of traffic data from the decentralised  
11 unit to the central unit is controlled by the  
12 programs according to predetermined criteria.

13

14 The existing methods utilise a road network model  
15 which has a number of predetermined subsections or  
16 detection points. Motion of the vehicles is measured  
17 with respect to these predetermined subsections or  
18 detection points. If greater detail is required  
19 about the motion of the vehicles, then a road network  
20 model with a greater density of subsections or points  
21 must be used, which greatly increases the  
22 communication and processing requirements of the  
23 system.

24

25 It is an object of the present invention to provide  
26 an apparatus and a method for monitoring traffic  
27 which enables more efficient monitoring in greater  
28 detail of a particular part of the road network  
29 without requiring increased communication and  
30 processing capacity.

31

1 According to a first aspect of the present invention,  
2 there is provided a method of selecting commencement  
3 and termination points on a road network for transit  
4 time measurements on a road network, wherein at least  
5 one point for at least one of the roads of the  
6 network is selected without that selection being  
7 determined by any other road of the network. The  
8 commencement and termination points are physical,  
9 geographical locations on the road network.

10

11 Preferably the road network comprises a plurality of  
12 node points interconnected by a plurality of route  
13 segments, each node point having at least three route  
14 segments associated with it. Preferably the at least  
15 one point is not coincident with any one of said  
16 plurality of node points.

17

18 Preferably the selection of the commencement and  
19 termination points takes place at a control centre.  
20 Preferably data defining the positions of the  
21 commencement and termination points is communicated  
22 from the control centre to a plurality of vehicles  
23 equipped to measure the transit time between the  
24 commencement and termination points and to  
25 communicate data relating to the measured transit  
26 time back to the control centre.

27

28 Preferably data defining the predicted transit time  
29 between the commencement and termination points is  
30 communicated from the control centre to the plurality  
31 of vehicles. Preferably each vehicle is equipped to

1 compare the measured transit time with the predicted  
2 transit time and to communicate data relating to the  
3 measured transit time back to the control centre only  
4 if the difference between the measured transit time  
5 and the predicted transit time exceeds a threshold  
6 value. The parameters defining the threshold value  
7 may also be communicated from the control centre to  
8 the plurality of vehicles.

9

10 According to a second aspect of the present  
11 invention, there is provided an apparatus for  
12 monitoring traffic, including a memory in which is  
13 recorded a programme for selecting commencement and  
14 termination points for transit time measurements on a  
15 road network, wherein the programme selects at least  
16 one point of said commencement and termination points  
17 for at least one of the roads of the network without  
18 that selection being determined by any other road of  
19 the network. The commencement and termination points  
20 are physical, geographical locations on the road  
21 network.

22

23 Preferably the road network comprises a plurality of  
24 node points interconnected by a plurality of route  
25 segments, each node point having at least three route  
26 segments associated with it. Preferably the at least  
27 one point is not coincident with any one of said  
28 plurality of node points.

29

30 Preferably the memory is in a control centre.  
31 Preferably the control centre includes communication

1 means adapted to transmit data defining the positions  
2 of the commencement and termination points from the  
3 control centre to a plurality of vehicles equipped to  
4 measure the transit time between the commencement and  
5 termination points. Preferably the communication  
6 means is adapted to receive data relating to the  
7 measured transit time from the vehicles.

8

9 Preferably there is recorded in the memory a  
10 programme for defining the predicted transit time  
11 between the commencement and termination points,  
12 wherein the programme calculates a predicted transit  
13 time dependent on one or more of the location of the  
14 points, the monitored traffic conditions and the time  
15 of day. Preferably the communication means is  
16 adapted to transmit data relating to the predicted  
17 transit time.

18

19 Owing to these aspects of the invention, it is  
20 possible to split up a road network for calculating  
21 transit times on that network without the splitting  
22 being predetermined by the make-up of the network,  
23 thereby giving complete flexibility in the choice of  
24 the location of the commencement and the termination  
25 points.

26

27 According to a third aspect of the present invention,  
28 there is provided a method of monitoring traffic  
29 comprising:

30

1       selecting a commencement point and a termination  
2       point,  
3  
4       communicating positional data for the commencement  
5       point and termination point to each of a plurality of  
6       vehicles,  
7  
8       at each of the plurality of vehicles monitoring when  
9       the vehicle passes from the commencement point to the  
10      termination point and calculating the transit time  
11      taken for the vehicle to travel between the two  
12      points,  
13  
14      comparing the transit time taken with a standard  
15      transit time for travel between the two points, and  
16  
17      communicating with a control centre if said transit  
18      time taken exceeds the said standard transit time by  
19      more than a preset amount.  
20  
21      The standard transit time and the preset amount may  
22      be selected at the control centre and communicated to  
23      each of the plurality of vehicles. The standard  
24      transit time and the preset amount may vary according  
25      to one or more of the location of the points, the  
26      monitored traffic conditions and the time of day.  
27  
28      According to a fourth aspect of the present  
29      invention, there is provided apparatus for monitoring  
30      traffic comprising a plurality of arrangements each  
31      carried by respective vehicles, each arrangement

1 comprising calculating means for calculating the  
2 transit time taken to travel between two points and  
3 for comparing the transit time taken with a standard  
4 transit time for travel between the two points and  
5 communicating means communicating with a control  
6 centre if said transit time taken exceeds the said  
7 standard transit time by more than a preset amount.

8

9 Preferably said communicating means is adapted to  
10 receive information from the control centre defining  
11 the position of at least one of the two points.  
12 Preferably the two points are a commencement point  
13 and a termination point respectively.

14

15 Owing to these aspects of the invention, it is  
16 possible to provide an in-vehicle traffic monitoring  
17 system in which the amount of data that needs to be  
18 transmitted to a control centre is minimised.

19

20 According to a fifth aspect of the present invention,  
21 there is provided a method of monitoring traffic  
22 comprising:

23

24 establishing along a road first and second points at  
25 respective ends of a route segment along which a  
26 vehicle is to travel, the route segment being  
27 subdivided into a number of links,

28

29 at the vehicle, calculating in turn the transit times  
30 taken for the vehicle to travel along respective  
31 links of the route segment,

1 in turn comparing the transit times taken with  
2 expected transit times for the respective links, and  
3  
4 communicating with a control centre if and when any  
5 of the transit times taken exceeds the corresponding  
6 expected transit time by a predetermined threshold.

9 Preferably each link extends from a commencement  
10 point to a termination point. Preferably the control  
11 centre transmits to the vehicle information defining  
12 the position of at least one of the said commencement  
13 point and termination point.

14  
15 According to a sixth aspect of the present invention,  
16 there is provided apparatus for monitoring traffic  
17 comprising:

18 establishing means arranged to establish along a road  
19 first and second points at respective ends of a route  
20 segment along which a vehicle is to travel, the route  
21 segment being subdivided into a number of links, and  
22  
23 an arrangement to be carried by the vehicle and  
24 comprising calculating means which serves to  
25 calculate in turn the transit times taken for the  
26 vehicle to travel along the said links, comparing  
27 means which serves to compare in turn the transit  
28 times taken with expected transit times for the  
29 respective links, and communicating means which serve  
30 to communicate with a control centre if and when any  
31

1 of said transit times taken significantly exceeds to  
2 corresponding expected transit time.

3

4 Preferably each link extends from a commencement  
5 point to a termination point. Preferably said  
6 communicating means is adapted to receive information  
7 from the control centre defining the position of at  
8 least one of the said commencement point and  
9 termination point.

10

11 Owing to these aspects of the invention, a relatively  
12 fast notification of a sudden incident, such as a  
13 road accident, can be obtained.

14

15 In order that the invention may be clearly and  
16 completely disclosed, reference will now be made, by  
17 way of example, to the accompanying drawing, in  
18 which:

19

20 Fig 1 is a diagram of parts of a traffic monitoring  
21 system,

22 Fig 2 is a diagrammatic perspective view of the  
23 system, and

24 Fig 3 is a schematic view of a road network.

25

26 Referring to the drawing, a vehicle 1 is fitted with  
27 an arrangement in the form of a unit 2 that includes  
28 a central processing unit (CPU) 3. The CPU 3  
29 includes a memory store. The CPU 3 is connected to  
30 an accurate time-measuring device 4, for example a  
31 crystal-controlled clock. The CPU 3 is also

1 connected to a Global Positioning System (GPS) device  
2 5 and to a two-way communication device 6, for  
3 example a GSM cellular telephone. Such units are  
4 known and the data transmitted by such a unit is  
5 referred to as floating car data. Instead of the GPS  
6 device other positioning systems may be used, for  
7 example triangulation using mobile telephony.

8  
9 The traffic monitoring system comprises a plurality  
10 of motor vehicles (including the vehicle 1) fitted  
11 with respective units 2, each unit 2 being capable of  
12 bi-directional communication, via the communication  
13 device 6, and a central two-way communication device  
14 7, for example a GSM apparatus, with a central  
15 control computer 8 at a control centre 10. The  
16 system can monitor road traffic congestion in real  
17 time.

18  
19 The memory of each unit 2 is loaded with geographic  
20 locations of specific points on roads, which are  
21 called "waypoints" for the purpose of this  
22 application. A waypoint needs no association with  
23 anything physical other than being on a road. For  
24 example, a waypoint does not need to be associated  
25 with a specific location such as a road junction or a  
26 crossroads, nor with a detector at a specific  
27 location, such as a bridge, along the road. There  
28 are no restrictions on the number of waypoints which  
29 may exist or their locations on the road. Each  
30 waypoint is a known distance from the next waypoint  
31 along the road, and the geographic distances between

1 them is called a "link". There are usually, but not  
2 necessarily, two links between two waypoints, one for  
3 each direction of travel. The memory of each unit 2  
4 is also loaded with estimated journey times along the  
5 links. These estimated journey times are called  
6 "link-times". There may be several link-times for  
7 each link, since the estimated journey time may  
8 change during the day, or for other reasons, such as  
9 roadworks. In Fig 2, two waypoints A and B are  
10 indicated, separated by a link C.

11

12 Fig 3 shows how the waypoints A and B, separated by  
13 link C, do not need to correspond to node points N in  
14 the road network. Each of the node points N is  
15 associated with three or more road segments S.  
16 However if required one or more waypoints may  
17 correspond to a node point N, as indicated by link C'  
18 joining waypoints A' and B', in which waypoint B'  
19 corresponds to a node point N.

20

21 In operation, whenever the vehicle 1 passes a  
22 waypoint A as determined by the device 5, the CPU 3  
23 notes the time supplied by the timer 4. When the  
24 vehicle 1 passes the next waypoint B as determined by  
25 the device 5, the CPU notes the time again. The CPU  
26 subtracts the two times to derive the actual  
27 journey time for the link C, and this is compared  
28 against the stored link-time for the link C. The  
29 results are stored in the unit 2 on a rolling basis.

30

1     If and when the actual journey time is greater by a  
2     preset amount than the stored link-time, then by  
3     means of the communication device 6 the unit 2  
4     transmits the relevant information (normally the  
5     actual journey time, but optionally other relevant  
6     information such as the deviation, position and  
7     absolute time) to the control computer 8 as soon as  
8     it is possible to do so. The preset amount may be  
9     fixed for the particular link, or may be the result  
10    of a calculation for example based on deviation above  
11    a specific percentage. If the actual journey time is  
12    less than the stored link-time, no transmission is  
13    made.

14

15    The control computer 8 receives deviations from the  
16    normal link-times from a plurality of vehicles, and  
17    from these calculates traffic flow and congestion,  
18    using one of several calculation methods already  
19    publicly known. Lower than expected speeds on a road  
20    are a reliable indicator of congestion.

21

22    Additionally, the unit 2 may upload its entire  
23    rolling record of actual journey times to the  
24    computer 8, which may use it to refine the accuracy  
25    of the link-times held in the CPU 3, using one of  
26    several calculation methods already publicly known.

27

28    Additionally, the computer 8 may download new  
29    information to the in-vehicle CPU 3, to modify its  
30    memory store of waypoints and link-times.

31

1 This approach to traffic congestion measurement gives  
2 a minimal communication cost, since each vehicle need  
3 transmit only one short message at the end of a link  
4 where there is congestion.

5

6 The use of waypoints removes all need for transit  
7 segments to be related to geographic or physical  
8 entities other than a road or roads, and is not  
9 limited to use with any particular form of  
10 navigation. Moreover the use of waypoints allows the  
11 resolution of monitoring to be infinitely varied  
12 along the length(s) of a road or roads. Waypoints  
13 can also be dynamically allocated. The number of  
14 waypoints on a particular section of road can vary  
15 according to the time of day, the day of the week,  
16 and/or the season, as appropriate. This variability  
17 of waypoints leads to a high degree of flexibility.  
18 More waypoints would be used when traffic is expected  
19 to be heavier and so more accurate information is  
20 obtained.

21

22 The statistical resolution, and hence accuracy, of  
23 such a system is dependent on the percentage of  
24 vehicles carrying units 2. Whenever the percentage  
25 is low, waypoints and link-times are defined  
26 preferably for only congested areas of motorway. As  
27 the number of equipped vehicles increases, coverage  
28 can be extended to all motorways and, ultimately, to  
29 any road with a statistically viable sample of  
30 vehicles.

31

1 In addition to notifying the control centre 10 when  
2 the vehicle 1 has exceeded a standard time for the  
3 link C between two waypoints A, B, the unit 2 can  
4 monitor the progress of the vehicle along the link C  
5 by monitoring its progress along sublinks. This  
6 technique is given the name "micro-pointing". For  
7 example, if a vehicle has 10km to travel between two  
8 waypoints A, B and it normally takes a link-time of  
9 ten minutes to travel this distance, the unit 2 can  
10 divide the link C into sublinks D, for example ten  
11 sublinks of one minute each. Using the GPS 5 to  
12 identify when each one-kilometre sublink D has been  
13 completed, the unit 2 notes the time taken for each  
14 sublink D. The unit 2 notifies the control centre 10  
15 when the time for a sublink D greatly exceeds the  
16 expected amount. In the above example a time of one  
17 minute 20 seconds for a sublink would not be  
18 perceived as resulting from a problem. However a  
19 time of three minutes for a sublink would result in  
20 the unit notifying the control centre 10 accordingly.  
21 If only one unit 2, corresponding to only one vehicle  
22 1, notifies the control centre 10, this would not  
23 necessarily mean that an incident, for example a road  
24 accident, affecting traffic flow generally has  
25 occurred. However, if a plurality of units 2, say  
26 four or more units 2 corresponding to four or more  
27 vehicles 1, all notify the control centre 10 at  
28 approximately the same time concerning the same  
29 sublink D, or possibly the same link C, then this  
30 would indicate the presence of an incident. Thus, if  
31 a sudden, great change in the sublink time occurs,

1 the unit 2 communicates this immediately to the  
2 control centre 10, giving relatively fast  
3 notification of an incident compared with the unit 2  
4 notifying the centre 10 either when the link-time has  
5 been greatly exceeded or even when the unit reaches  
6 the waypoint B at the end of the link C. Again, the  
7 degree of micro-pointing, i.e. the number of sublinks  
8 D into which any particular link C is divided, can be  
9 varied according to the time of day, the day of the  
10 week, or the season, as appropriate.

11

12 The method and apparatus of the invention offers  
13 significant advantages over prior art traffic  
14 monitoring systems. It offers a fast response to  
15 traffic situations, since it can quickly report  
16 changes in sublink times. It offers low  
17 communications costs, since data is only transmitted  
18 from the vehicle to the central station when a  
19 predetermined threshold is reached. Most in-vehicle  
20 measurements will not be reported. It can generate  
21 meaningful statistical traffic information from a  
22 single vehicle, since the progress of a single  
23 vehicle over a number of adjacent links or sublinks  
24 can be monitored. Road coverage can be dynamically  
25 extended as the population of equipped vehicles  
26 increases, simply by defining additional waypoints.  
27 Reporting parameters can be dynamically varied,  
28 giving the most appropriate balance between accuracy,  
29 response and communications cost at any time. For  
30 example the linktime, and hence the threshold at  
31 which reporting takes place, can be varied according

1 to the time of day so that the threshold is higher in  
2 the rush hour than outside peak travel times.

3

4 It should be noted that each vehicle 1 is equipped  
5 identically with the same unit 2. Each unit 2  
6 communicates only with the central station 10, and  
7 units 2 do not communicate with each other.

8

9 The units 2 do not measure speed against time  
10 intervals, nor do they use the measurement of  
11 velocity from a GPS receiver. Instead a unit 2  
12 measures the time of travel between a first waypoint  
13 and a second waypoint, and compares this measured  
14 time with a control, namely the linktime stored in  
15 the memory of the unit 2. Waypoints are defined at  
16 the central station, not at the unit 2 in the  
17 vehicle. The definition of waypoints may be dynamic,  
18 so that the central station 10 communicates to each  
19 unit updated waypoint definition data according to  
20 traffic conditions monitored at the central station,  
21 or the definition of waypoints may be preset in each  
22 unit, so that updating of waypoint information in the  
23 units only takes place at particular times.

24

25 Waypoints do not need to correspond to road  
26 junctions, although they can do. The only geographic  
27 limitation on a waypoint is that it corresponds to a  
28 position on a road forming part of the road network  
29 to be monitored. A waypoint is a virtual reference  
30 point and does not have to correspond to any physical  
31 feature.

1 Modifications and improvements may be made to the  
2 embodiments without departing from the scope of the  
3 invention. For instance, any positioning system 5  
4 may be used in the unit 2 in each vehicle 1, and the  
5 invention is not limited to GPS systems. Indeed the  
6 unit 2 does not need a navigation system. Any form  
7 of communication system 5 may be used in the unit 2  
8 in each vehicle 1, and the invention is not limited  
9 to GSM systems. If the possibility of the control  
10 computer 8 defining new waypoints is not required,  
11 then the communication system 5 may be a one way  
12 system, used only to transmit data from the vehicle 1  
13 to the control centre 10, with all waypoint  
14 information being provided in pre-programmed form,  
15 for example on a CD-ROM or other readable storage  
16 device.

18

## CLAIMS:

- 1 1. A method of selecting commencement and  
2 termination points on a road network for transit  
3 time measurements on the road network, wherein at  
4 least one point for at least one of the roads of  
5 the network is selected without that selection  
6 being determined by any other road of the network.  
7
- 8 2. The method of Claim 1, wherein the road network  
9 comprises a plurality of node points  
10 interconnected by a plurality of route segments,  
11 each node point having at least three route  
12 segments associated with it.  
13
- 14 3. The method of Claim 2, wherein the at least one  
15 point is not coincident with any one of said  
16 plurality of node points.  
17
- 18 4. The method of any preceding claim, wherein the  
19 selection of the commencement and termination  
20 points takes place at a control centre.  
21
- 22 5. The method of Claim 4, wherein data defining the  
23 positions of the commencement and termination  
24 points is communicated from the control centre to  
25 a plurality of vehicles equipped to measure the  
26 transit time between the commencement and  
27 termination points and to communicate data  
28 relating to the measured transit time back to the  
29 control centre.

- 1
- 2     6. The method of Claim 5, wherein data defining the
- 3         predicted transit time between the commencement
- 4         and termination points is communicated from the
- 5         control centre to the plurality of vehicles.
- 6
- 7     7. The method of Claim 6, wherein each vehicle is
- 8         equipped to compare the measured transit time with
- 9         the predicted transit time and to communicate data
- 10        relating to the measured transit time back to the
- 11        control centre only if the difference between the
- 12        measured transit time and the predicted transit
- 13        time exceeds a threshold value.
- 14
- 15     8. The method of Claim 7, wherein the parameters
- 16         defining the threshold value may also be
- 17         communicated from the control centre to the
- 18         plurality of vehicles.
- 19
- 20     9. An apparatus for monitoring traffic, including a
- 21         memory in which is recorded a programme for
- 22         selecting commencement and termination points on a
- 23         road network for transit time measurements on the
- 24         road network, wherein the programme selects at
- 25         least one point of said commencement and
- 26         termination points for at least one of the roads
- 27         of the network without that selection being
- 28         determined by any other road of the network.
- 29
- 30     10. The apparatus of Claim 9, wherein the road
- 31         network comprises a plurality of node points

1       interconnected by a plurality of route segments,  
2       each node point having at least three route  
3       segments associated with it.

4

5       11. The apparatus of Claim 10, wherein the at least  
6       one point is not coincident with any one of said  
7       plurality of node points.

8

9       12. The apparatus of any of Claims 9 to 11, wherein  
10      the memory is in a control centre.

11

12      13. The apparatus of Claim 12, wherein the control  
13      centre includes communication means adapted to  
14      transmit data defining the positions of the  
15      commencement and termination points from the  
16      control centre to a plurality of vehicles equipped  
17      to measure the transit time between the  
18      commencement and termination points.

19

20      14. The apparatus of Claim 13, wherein the  
21      communication means is adapted to receive data  
22      relating to the measured transit time from the  
23      vehicles.

24

25      15. The apparatus of either Claim 13 or Claim 14,  
26      wherein the communication means is adapted to  
27      transmit data relating to the predicted transit  
28      time.

29

30      16. The apparatus of any of Claims 9 to 15, wherein  
31      there is recorded in the memory a programme for

1 defining the predicted transit time between the  
2 commencement and termination points, wherein the  
3 programme calculates a predicted transit time  
4 dependent on one or more of the location of the  
5 points, the monitored traffic conditions and the  
6 time of day.

7

8 17. A method of monitoring traffic comprising:  
9 selecting a commencement point and a termination  
10 point on a road network,  
11 communicating positional data for the commencement  
12 point and termination point to each of a plurality  
13 of vehicles,  
14 at each of the plurality of vehicles monitoring  
15 when the vehicle passes from the commencement  
16 point to the termination point and calculating the  
17 transit time taken for the vehicle to travel  
18 between the two points,  
19 comparing the transit time taken with a standard  
20 transit time for travel between the two points,  
21 and  
22 communicating with a control centre if said  
23 transit time taken exceeds the said standard  
24 transit time by more than a preset amount.

25

26 18. The method of Claim 17, wherein the standard  
27 transit time and the preset amount are selected at  
28 the control centre and communicated to each of the  
29 plurality of vehicles.

30

1       19. The method of either Claim 17 or Claim 18,  
2       wherein the standard transit time and the preset  
3       amount vary according to one or more of the  
4       location of the points, the monitored traffic  
5       conditions and the time of day.

6

7       20. An apparatus for monitoring traffic in a road  
8       network comprising a plurality of arrangements  
9       each carried by respective vehicles, each  
10      arrangement comprising calculating means for  
11      calculating the transit time taken to travel  
12      between two points and for comparing the transit  
13      time taken with a standard transit time for travel  
14      between the two points and communicating means  
15      communicating with a control centre if said  
16      transit time taken exceeds the said standard  
17      transit time by more than a preset amount, wherein  
18      said communicating means is adapted to receive  
19      information from the control centre defining the  
20      position on the road network of at least one of  
21      the two points.

22

23      21. The apparatus of Claim 20, wherein the two  
24      points are a commencement point and a termination  
25      point respectively.

26

27      22. A method of monitoring traffic comprising:  
28       establishing along a road first and second  
29       points at respective ends of a route segment along  
30       which a vehicle is to travel, the route segment  
31       being subdivided into a number of links,

1           at the vehicle, calculating in turn the transit  
2           times taken for the vehicle to travel along  
3           respective links of the route segment,  
4           in turn comparing the transit times taken with  
5           expected transit times for the respective links,  
6           and

7           communicating with a control centre if and when  
8           any of the transit times taken exceeds the  
9           corresponding expected transit time by a  
10          predetermined threshold.

11

12        23. The method of Claim 22, wherein each link  
13           extends from a commencement point to a termination  
14           point.

15

16        24. The method of Claim 23, wherein the control  
17           centre transmits to the vehicle information  
18           defining the position of at least one of the said  
19           commencement point and termination point.

20

21        25. An apparatus for monitoring traffic comprising:  
22           establishing means arranged to establish along a  
23           road first and second points at respective ends of  
24           a route segment along which a vehicle is to  
25           travel, the route segment being subdivided into a  
26           number of links, and  
27           an arrangement to be carried by the vehicle and  
28           comprising calculating means which serves to  
29           calculate in turn the transit times taken for the  
30           vehicle to travel along the said links, comparing  
31           means which serves to compare in turn the transit

1       times taken with expected transit times for the  
2       respective links, and communicating means which  
3       serve to communicate with a control centre if and  
4       when any of said transit times taken significantly  
5       exceeds to corresponding expected transit time.

6

7       26. The apparatus of Claim 25, wherein each link  
8       extends from a commencement point to a termination  
9       point.

10

11       27. The apparatus of Claim 26, wherein said  
12       communicating means is adapted to receive  
13       information from the control centre defining the  
14       position of at least one of the said commencement  
15       point and termination point.

16

17       28. A method of selecting commencement and  
18       termination points for transit time measurements  
19       on a road network substantially as hereinbefore  
20       described with reference to the accompanying  
21       drawings.

22

23       29. An apparatus for monitoring traffic  
24       substantially as hereinbefore described with  
25       reference to the accompanying drawings.

26

27       30. A method of monitoring traffic substantially as  
28       hereinbefore described with reference to the  
29       accompanying drawings.



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Claims searched: 1 to 30

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**Patents Act 1977**  
**Search Report under Section 17**

**Databases searched:**

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.S): G1N (NAAJC2 HJA, HJD)

Int Cl (Ed.7): G01C (21/00, 21/14, 21/16, 21/26) G08G (1/01)

Other: Online: WPI, EPODOC, PAJ

**Documents considered to be relevant:**

Category	Identity of document and relevant passage	Relevant to claims
X	EP 0902406 A2 (MANNESMANN) see abstract and figure	1 and 9 to 12
X	EP 0605848 A1 (UNION SWITCH) column 7	1 and 9 to 12
X,E	WO 00/31705 A2 (LANG)	1 and 9 to 12
X	WO 98/27524 A1 (MANNESMAN) see abstract and figure 1	1 and 9 to 12
X	WO 95/14292 A1 (PHILIPS)	1 and 9 to 12

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.